annealing 450-540 °C
_ 450-690°C

PATENT ABSTRACTS OF JAPAN

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(54) IRON-NICKEL ALLOY SHEET AND IRON-NICKEL-COBALT ALLOY SHEET FOR ELECTRONIC PARTS, EXCELLENT IN DEGREASING PROPERTY, AND THEIR PRODUCTION

(57)Abstract:
PURPOSE: To produce an Fe-Ni alloy sheet and an Fe-Ni-Co alloy sheet for electronic parts, excellent in etching characteristic, by improving degreasing property.
CONSTITUTION: An Fe-Ni alloy sheet or an Fe-Ni-Co alloy sheet, containing, by weight, 26-52% Ni and ≤0.1% Sn or further containing 1-20% Co, is used. This alloy sheet is subjected to a repetition of cold rolling and annealing, and then finish rolling is performed by using a dull roll at 15-80% rolling rate to regulate surface roughness to 40-200μm RSm and 0.3-1.5 Rsk. Subsequently, stress relief annealing is carried out in an atmosphere consisting of ≥1vol.% H2, ≤0.02vol.% O2, and the balance inert gas and having -10 to -60°C dew point. At this time, temp. is raised at (3 to 50)° C/sec temp. rise rate and annealing is performed at 450-690°C annealing temp., and then cooling is done at (3 to 150)°C/sec cooling rate.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the Fe-nickel system alloy sheet metal and Fe-nickel-Co system alloy sheet metal which are used as a functional material of various electronic parts, such as shadow masks for the color picture tubes etc., and IC leadframe, and its manufacturing method.
[0002]
[Description of the Prior Art] The sheet metal which the Fe-nickel system alloy and Fe-nickel-Co system alloy which contain nickel 26 to 52% show a low coefficient of thermal expansion in the temperature region ranging from the room temperature to 300 degrees C, and consists of these alloys is widely used as a functional material of various electronic parts, such as shadow masks for the color picture tubes etc., and IC leadframe.
[0003] Below, it explains taking the case of a shadow mask. After it bakes a pattern after being processed into predetermined board thickness and the alloy sheet metal of the material for shadow masks applies a resist to both sides after degreasing, and it removes etching punching and a resist using the etching reagent which makes a ferric chloride a subject after development, it is cut separately and used as a flat mask. A flat mask is annealed in a non-oxidizing atmosphere, in order to improve a moldability, subsequently after [leveler processing] press forming is carried out, and it is fabricated by the mask configuration. Furthermore, after degreasing, melanism processing is performed in a steam or combustion gas atmosphere, a black oxide film is formed in a front face, and a shadow mask is produced.
[0004] In recent years, the use expansion to the display unit of a computer etc. and the demand of conjointly as opposed to the delicacy of a display picture are increasing much more. Therefore, the highly minute mask 300 micrometers or less is further demanded for the aperture pitch made detailed by high density in the hole formed of etching punching. Since the delicacy of a picture will be influenced if there are the path of pore and the variation of a configuration which are formed of etching punching in the case of a highly minute mask, the technology of improving these etching unevenness is proposed.
[0005] For example, it notes that variation arises in the path and configuration of the pore formed in JP,1-56824,A by etching punching of the variation in the adhesion of a resist. On the occasion of manufacture of a shadow mask material, the reduction roll which gave surface dull processing with laser beam machining at the last cold rolling process is used. Are set surface roughness Ra (center line average coarseness) of a material to 0.2-1.0 micrometers, and RSm (average of the interval of the irregularity of the roughness curve which shows the surface roughness in criteria length) is set to 100 micrometers or less. The technology of improving etching unevenness is proposed by making the adhesion force of a resist into the suitable range.
[0006]
[Problem(s) to be Solved by the Invention] However, it is required to use the special roll by laser beam machining, the new facility for it is needed, and some which are depended on the aforementioned technology have the evil in which a cost rise is caused. For this reason, the Fe-nickel system alloy sheet metal row for electronic parts with little etching unevenness was expected the technology in which Fe-nickel-Co system alloy sheet metal could be obtained cheaply, without needing new equipment.
[0007] It aims at providing the Fe-nickel alloy sheet metal row for electronic parts with little etching unevenness with Fe-nickel-Co system alloy sheet metal and its manufacture method, without making this invention in consideration of this situation, and needing a new facility.
[0008]
[Means for Solving the Problem] The composition which is originated in piles and makes examination the summary in view of the actual condition which described this invention above is as follows.
[0009] (1) Fe-nickel system alloy sheet metal for electronic parts which is Fe-nickel system alloy sheet metal containing less than [Sn:0.1%], and the oxide film with a thickness of 10-200A was formed in the front face nickel:26-52%, and was excellent in weight % at the degreasing nature whose contact angle of the front face by the waterdrop contact angle method on the oxide film concerned is 40-90 degrees.
[0010] (2) Fe-nickel system alloy sheet metal for electronic parts which was excellent in the degreasing nature whose surface roughness of the Fe-nickel system alloy sheet metal before the aforementioned oxide-film formation is RSm:40-200micrometer and Rsk:0.3-1.5 in the Fe-nickel system alloy sheet metal for electronic parts of the above (1).
[0011] (3) Fe-nickel-Co system alloy sheet metal for electronic parts which is Fe-nickel-Co system alloy sheet metal

containing less than [Sn:0.1%], and the oxide film with a thickness of 10-200A was formed in the front face nickel:26-52% and Co:1-20%, and was excellent in weight % at the degreasing nature whose contact angle of the front face by the waterdrop contact angle method on the oxide film concerned is 40-90 degrees.
[0012] (4) Fe-nickel-Co system alloy sheet metal for electronic parts which was excellent in the degreasing nature whose surface roughness of the Fe-nickel-Co system alloy sheet metal before the aforementioned oxide-film formation is RSm:40-200micrometer and Rsk:0.3-1.5 in the Fe-nickel system alloy sheet metal for electronic parts of the aforementioned (3) publication.
[0013] (5) By weight %, the Fe-nickel system alloy sheet metal containing less than [Sn:0.1%] nickel:26-52% Finishing rolling after obtaining cold rolling and annealing in Japanese common chestnut and carrying out 1 time or twice or more, The aforementioned finishing rolling is rolled out at 15 - 80% of rates of rolling using a dull roll in carrying out stress relieving annealing and manufacturing Fe-nickel system alloy sheet metal. The surface roughness is set to RSm:40-200micrometer and Rsk:0.3-1.5. Become more than H2 1vol%, less than [O2 0.02vol%], and a remainder real target from inert gas, and the aforementioned stress relieving annealing in the atmosphere whose dew-point is -10--60 degree C A temperature up is carried out by the 3-50 degrees C [/second] programming rate. at 450-690 degrees C of annealing temperatures After annealing, The manufacture method of the Fe-nickel system alloy sheet metal for electronic parts excellent in the degreasing nature which cools with the cooling rate of 3-150 degrees C/second, forms an oxide film with a thickness of 10-200A in the front face, and makes the contact angle of the front face by the waterdrop contact angle method 40-90 degrees.
[0014] (6) By weight %, the Fe-nickel-Co system alloy sheet metal containing less than [Sn:0.1%] nickel:26-52% and Co:1-20% Finishing rolling after obtaining cold rolling and annealing in Japanese common chestnut and carrying out 1 time or twice or more, In carrying out stress relieving annealing and manufacturing Fe-nickel-Co system alloy sheet metal The aforementioned finishing rolling is rolled out at 15 - 80% of rates of rolling using a dull roll. The surface roughness is set to RSm:40-200micrometer and Rsk:0.3-1.5. Become more than H2 1vol%, less than [O2 0.02vol%], and a remainder real target from inert gas, and the aforementioned stress relieving annealing in the atmosphere whose dew-point is -10--60 degree C A temperature up is carried out by the 3-50 degrees C [/second] programming rate. at 450-690 degrees C of annealing temperatures After annealing, The manufacture method of the Fe-nickel-Co system alloy sheet metal for electronic parts excellent in the degreasing nature which cools with the cooling rate of 3-150 degrees C/second, forms an oxide film with a thickness of 10-200A in the front face, and makes the contact angle of the front face by the waterdrop contact angle method 40-90 degrees.
[0015]
[Function] this invention person etc. is based on having acquired the following knowledge, as a result of repeating research wholeheartedly from said viewpoint that cheap Fe-nickel system alloy sheet metal and Fe-nickel-Co system alloy sheet metal (henceforth Fe-nickel system alloy sheet metal etc.) should be developed.
[0016] (1) There is a thing resulting from the variation in the thickness of the resist applied in advance of etching punching in etching unevenness, and be closely related to the measured value of the contact angle by the waterdrop contact angle method this variation expresses the grade of degreasing of the alloy sheet metal before a resist application.
[0017] (2) chemical compositions, such as Fe-nickel system alloy sheet metal, surface roughness, and Fe -- by specifying the thickness of a rich oxide film in the proper range, become the front face of the outstanding degreasing nature and lessen variation in resist thickness furthermore, about the Fe-nickel system alloy strip which has specific component composition as the manufacture method of the (3) aforementioned alloy sheet metal In finishing-rolling out, carrying out stress relieving annealing of cold-rolling and the annealing, 1 time or after repeating twice or more, and manufacturing alloy sheet metal The Fe-nickel system alloy sheet metal of the degreasing nature which was excellent by specifying composition and the dew-point of the rate of rolling of finishing rolling and the atmosphere of stress relieving annealing, an annealing temperature, a programming rate, and a cooling rate in the predetermined range etc. can be obtained.
[0018] Below, the reason for limitation of this invention is explained. nickel is an important component element for considering the alloy sheet metal of this invention as low-fever expansion. The upper limit of the average coefficient of thermal expansion in the 30-100-degree C temperature region which in the case of the charge of shadow mask material is demanded in order to prevent a color gap is 3.0x10-6/degree C. In the case of a Fe-nickel system alloy, the amount of nickel which fulfills the conditions of this average coefficient of thermal expansion is 30 - 38% of range. Therefore, in the case of the charge of shadow mask material, you should limit the amount of nickel to 30 - 38% of range. In addition, the desirable amount of nickel is 35 - 37% rather than within the limits of such an amount of nickel may also reduce an average coefficient of thermal expansion.
[0019] In addition, the amount of nickel with which are satisfied of the upper limit of an average coefficient of thermal expansion described above even when Co was contained by less than 1% of within the limits is 30 - 38%, and the desirable amount of nickel in which an average coefficient of thermal expansion is reduced is 35 - 37%.
[0020] Moreover, the amount of nickel which fulfills the conditions of an average coefficient of thermal expansion mentioned above in the case of the Fe-nickel-Co system alloy containing 1 - 8% of Co is 26 - 38%, and when the amount of nickel is 30 - 33% and the amount of Co(es) is 3 - 8%, an average coefficient of thermal expansion becomes what was still lower excellent.
[0021] Moreover, in the case of the charge of IC leadframe material, it is necessary to maintain the adjustment of thermal expansion with a semiconductor device, glass, ceramics, etc., and for that to make the amount of nickel into 38% or more and 52% or less. Therefore, in the case of the charge of IC leadframe material, you should limit the amount of nickel to 38% or

more and 52% or less of range. Within the limits of such an amount of nickel, the amount of nickel is appropriately chosen according to coefficients of thermal expansion, such as a semiconductor device, glass, and ceramics.
[0022] In addition, when it contains Co by less than 1% of within the limits, the amount of nickel for maintaining the adjustment of the thermal expansion as an object for IC leadframes is 38 - 52%. Moreover, in this case, although the Fe-nickel-Co system alloy is also made into the object of this invention as a charge of IC leadframe material, if the amount of Co(es) is 1 - 20% and the amount of nickel is 26 - 38%, the adjustment of the thermal expansion as an object for IC leadframes can be maintained.
[0023] Now, in the above-mentioned Fe-nickel system alloy sheet metal of a chemical composition etc., variation in resist thickness can be lessened by making suitable degreasing nature of the alloy sheet metal before a resist application.
[0024] In order to lessen variation in resist thickness, it is necessary to make into 40-90 degrees the contact angle measured by the waterdrop contact angle method. At less than 40 degrees, the drainer nature after degreasing has a bad contact angle, and the application state of a resist becomes uneven by slight survival of moisture. Since the homogeneity of degreasing is inferior when a contact angle exceeds 90 degrees, the application state of a resist becomes uneven by local survival for fats and oils etc.
[0025] in order to make it the range which described the contact angle above -- rationalization of the surface roughness (Rsk, RSm) of alloy sheet metal, and Fe -- Sn content in an alloy needs formation of a rich oxide film, and to be rationalized
[0026] The surface roughness of an alloy sheet metal front face needs to set to 40-200 micrometers 0.3-1.3, and RSm (average of the interval of the irregularity of the roughness curve which shows the surface roughness in criteria length) for Rsk (deviation ratio of the height direction of a roughness curve). The homogeneity of degreasing will become bad, if Rsk exceeds less than 0.3 and RSm exceeds 200 micrometers. On the other hand, Rsk exceeds 1.3 and the drainer nature of degreasing becomes [RSm] bad by less than 40 micrometers.
[0027] a convention of surface roughness which was described above in this invention -- adding -- Fe with a thickness of 10-200A -- a rich oxide film needs to be formed The homogeneity of degreasing will not be acquired, if the thickness of this oxide film is inferior in the drainer nature of degreasing and exceeds 200A in less than 10A. When the thickness of an oxide film is 10-200A, the degreasing nature excellent in addition of Sn mentioned later and the drainer nature conjointly meant by this invention is obtained.
[0028] To the improvement of homogeneity in degreasing sake the above-mentioned Fe -- in addition to rationalization of rich oxide-film thickness, a convention of the amount of Sn in an alloy is effective If Sn is in this alloy, although it is the impurity element mixed from the scrap of an iron source etc., since the homogeneity of degreasing demanded with this alloy will fall, and it is not desirable, the upper limit is made [if the amount of Sn exceeds 0.1%,] into 0.1%. Sn -- the inside of the manufacturing process of alloy sheet metal -- if -- in order not to generate an oxide -- the interface of an oxide film and an alloy ground -- condensing -- Fe -- formation of a rich oxide film is promoted
[0029] In addition, in this alloy sheet metal, as for the component composition of those other than said nickel, Co, and Sn, it is desirable that they are less than [C:0.06wt%], less than [O:0.005wt%], less than [S:0.003wt%], less than [P:0.01wt%], less than [N:0.003wt%], and H:3.0 ppm or less in order to secure the outstanding processability. Furthermore, it is desirable to consider as less than [B:0.0005wt%] less than [Mn:0.50wt%] and Si:0.001 - 0.25wt%.
[0030] For the formation of a melanism film which has the high degree of black, ** of Mn which is a detrimental element and is reduced is desirable. Since the spinel oxide containing Mn will be formed and the melanism film which was excellent in the degree of black will be hard to be formed if the amount of Mn exceeds 0.50wt(s)%, it considers as a 0.50wt% upper limit. In addition, if this amount of Mn is low less than [0.50wt%], like a low, the degree of black increases and can also make the rate of thermal radiation high.
[0031] Moreover, Si forms in the front face of a flat mask the oxide film which makes Si effective in printing prevention a subject at the time of annealing of the flat mask made with the Fe-nickel system alloy sheet metal for shadow masks, and has the operation which prevents printing of a flat mask. However, a desired effect is not acquired by the operation which this Si content mentioned above less than [0.001wt%]. if Si content exceeds 0.25wt(s)% on the other hand -- the time of etching punching of Fe-nickel system alloy sheet metal -- a hole -- it is remarkably ruined and etching punching nature becomes bad Therefore, as for Si content, it is desirable to limit to the range of 0.001 - 0.25wt%.
[0032] Although B raises hot-working nature, if a content increases, a segregation will be carried out to the grain boundary of the recrystallization grain formed at the time of annealing before a press, a grain boundary is made hard to move, austenite grain-growth nature is checked as a result, it is after annealing before press molding, and the necessary diameter of austenite crystal grain is no longer obtained. In order to work uniformly to no crystal grain, a duplex grain structure remarkable as a result is shown, the elongation nonuniformity at the time of press molding occurs, and the inhibitory action of grain growth causes transparency nonuniformity. If this amount of B exceeds 0.0005wt(s)%, since the average austenite particle size (15-45 micrometers) demanded on the configuration freeze disposition at the time of press molding for prevention of transparency nonuniformity generating after crack generating suppression and press molding of an alloy board will no longer be obtained and problems, such as transparency nonuniformity at the time of a press, will also be generated, as for the upper limit of the amount of B, considering as 0.0005wt(s)% is desirable.
[0033] It faces finishing-rolling out, carrying out stress relieving annealing of cold-rolling and the annealing for the alloy strip of said component composition, 1 time or after repeating twice or more, and manufacturing the Fe-nickel system alloy sheet metal of this invention etc., and the aforementioned finishing rolling conditions and stress-relieving-annealing conditions need

to be rationalized.
[0034] It is necessary to make the rate of rolling of finishing rolling into 15 - 80%. the bottom of the optimal stress relieving annealing which the rate of rolling mentions later at less than 15% -- Fe -- only less than 10A of rich oxide films is not formed, and the outstanding drainer nature of degreasing is not obtained On the other hand, if the rate of rolling exceeds 80%, under the optimal stress relieving annealing, the oxide film exceeding 200A is formed and the homogeneity of degreasing cannot be secured.
[0035] Moreover, the surface roughness of the alloy sheet metal of said this invention can be obtained in finishing rolling using the work roll of a dull finish with a diameter of 200mm or less whose surface roughness is Rsk:-0.5--1.3 and RSm:40-250micrometer by rolling out at 15% or more of rate of rolling.
[0036] As stress relieving annealing, it is a controlled atmosphere H2 More than 1vol% and O2 It is required to make less than [0.02vol%] and the remainder into inert gas substantially, to be the atmosphere the dew-point of whose is -10--60 degree C, to carry out a temperature up by the 3-50 degrees C [/second] programming rate, and to cool with the cooling rate of 3-150 degrees C/second after annealing at 450-690 degrees C of annealing temperatures.
[0037] a programming rate -- 50 degrees C/second -- exceeding -- an annealing temperature -- less than 450 degrees C and a cooling rate -- 150 degrees C/second -- exceeding -- a dew-point -- less than -60 degrees C -- stress relieving annealing -- Fe -- since only less than 10A of thickness of a rich oxide film is not formed, the outstanding drainer nature of degreasing cannot be obtained
[0038] moreover, a programming rate -- less than 3 degrees C/[a second and] and an annealing temperature -- case less than 3 degrees C/[a second and] and a dew-point have 690-degree-C ** and a cooling rate higher than -10 degrees C -- H2 concentration -- less than [1vol%] and O2 concentration -- 0.02vol(s)% -- exceeding -- coming out -- Fe formed by stress relieving annealing -- since the thickness of a rich oxide film exceeds 200A, the homogeneity of outstanding degreasing is not securable
[0039]
[Example] Below, an example is explained.
[0040] (Example 1) It repaired, and after the component composition shown in Table 1 and the remainder ingoted the alloy steel which consists of Fe and an unescapable impurity and considered as the steel ingot by the ingot making method about alloy steel A and C and J-M, slabbing of the steel ingot was carried out, and it was used as slab, and was used as slab by the continuous casting process about alloy steel B and D by ladle refinement. these slab -- surface ****** -- it hot-rolled and ******(ed) and considered as the hot-rolling coil Cold rolling-annealing-finishing rolling-stress relieving annealing was performed for this hot-rolling coil, and alloy sheet metal No.1-No.10 of 0.15mm of board thickness were obtained.
[0041] Finishing rolling used the work roll of 120mm of diameters, and rolled it out at 30% of rates of rolling. The surface roughness of the used work roll is [6 / No.] Rsk-0.5--1.3 and 40-250 micrometers of RSm(s) about Rsk-1.0, RSm280micrometer, and No.8 except Rsk+0.5, RSm105micrometer, No.6, and No.8.
[0042] Stress relieving annealing was based on the following conditions. No.9 -- H2 : 60vol% and O2 : 0.005vol% and the remainder -- N2 from -- it became, it is the atmosphere whose dew-point is -50 degrees C, and the temperature up was carried out in a second in 70 degrees C /, and after annealing for 0.2 seconds at 540 degrees C, it cooled in a second in 100 degrees C / About No.10, it was the same atmosphere as No.9, the temperature up was carried out in a second in 3 degrees C /, and after annealing for 400 seconds at 540 degrees C, it cooled in a second in 1 degree C /. others -- H2 : 99vol% and O2 : 0.005vol% and the remainder -- N2 from -- it became, it is the atmosphere whose dew-point is -50 degrees C, and the temperature up was carried out in a second in 25 degrees C /, and after annealing for 300 seconds at 540 degrees C, it cooled in a second in 50 degrees C /
[0043] The surface roughness of the obtained alloy sheet metal, oxide-film thickness, a contact angle, and degreasing nature were investigated. By the Auger-analysis method, the spatter of the oxide-film thickness was carried out in the depth direction from the front face by Ar ion, it measured the Auger electron peak, measured thickness until the same Auger spectrum as bulk (base material) is obtained from a front face, and made it oxide-film thickness.
[0044] The contact angle trickled tap water on the waterdrop contact angle method, i.e., a test piece, measured the angle of the waterdrop made on the test piece using the microscope 10 times the scale factor with a protractor graduation of this, and asked for it from the angle theta shown in drawing 1 .
[0045] 40 degrees or more were estimated as "O", and, as for homogeneity, the contact angle estimated less than 40 degrees by the waterdrop contact angle method as "x." Moreover, as for drainer nature, the contact angle estimated "O" and 90-degree super-** for 90 degrees or less by the waterdrop contact angle method as "x." A result is shown in Table 2.
[0046]
[Table 1]

合金No.	化学成分 (wt%)												
	Ni	H(ppm)	Mn	Si	O	N	B	P	S	C	Co	Sn
A	35.5	0.5	0.27	0.002	0.0010	0.0012	0.0001	0.002	0.0003	0.0015	—	0.002
B	36.5	1.0	0.05	0.03	0.0021	0.0017	0.0001	0.003	0.0016	0.0048	0.013	0.008
C	38.2	0.9	0.14	0.01	0.0013	0.0010	0.0001	0.001	0.0007	0.0025	0.520	0.005
D	31.5	1.8	0.35	0.03	0.0025	0.0018	<0.0001	0.002	0.0024	0.0098	5.50	0.085
J	35.2	1.2	0.31	0.07	0.0030	0.0024	0.0002	0.004	0.0028	0.0150	—	0.153
K	35.9	1.5	0.30	0.10	0.0027	0.0020	0.0002	0.005	0.0026	0.0142	—	0.0001
L	36.7	1.1	0.32	0.07	0.0025	0.0022	0.0001	0.004	0.0030	0.0230	0.016	0.125
M	35.2	1.3	0.35	0.08	0.0026	0.0023	0.0001	0.004	0.0035	0.0200	—	0.005

[0047]
[Table 2]

材料No.	合金No.	材料の表面粗さ		酸化膜厚さ (Å)	接触角 (°)	脱脂性		備考
		Rsk	RSm (μm)			均一性	水きり性	
1	A	0.5	50	70	80	○	○	発明例
2	B	1.2	80	50	75	○	○	発明例
3	C	0.8	180	30	45	○	○	発明例
4	D	0.7	130	50	48	○	○	発明例
5	J	1.3	100	230	100	×	○	比較例
6	K	0.5	230	40	95	×	○	比較例
7	L	0.9	140	210	110	×	○	比較例
8	M	0.2	180	210	95	×	○	比較例
9	A	0.7	90	5	30	○	×	比較例
10	A	0.6	180	260	120	×	○	比較例

[0048] From this result, homogeneity and the drainer nature of No.1-No.4 of the example of this invention are good, and the

outstanding degreasing nature is shown. On the other hand, each of No.5 to which Sn content exceeds the upper limit of this invention, No.7 and No.8 in which Rsk is less than the minimum of this invention, and No.10 in which a cooling rate separates from the minimum of this invention is inferior in homogeneity. Moreover, No.6 to which RSm exceeds the upper limit of this invention, and No.9 to which a programming rate exceeds the upper limit of this invention are inferior in drainer nature.

[0049] (Example 2) It repaired, and after the component composition shown in Table 3 and the remainder ingoted the alloy steel which consists of Fe and an unescapable impurity and considered as the steel ingot by the ingot making method about alloy steel E and G and N-Q, slabbing of the steel ingot was carried out, and it was used as slab, and was used as slab by the continuous casting process about alloy steel F, H, and I by ladle refinement. these slab -- surface ****** -- it hot-rolled and ******(ed) and considered as the hot-rolling coil Cold rolling-annealing-finishing rolling-stress relieving annealing was performed for this hot-rolling coil, and alloy sheet metal No.11-No.21 of 0.15mm of board thickness were obtained.

[0050] Finishing rolling used the work roll of 120mm of diameters, and rolled it out at 70% of rates of rolling. The surface roughness of the used work roll is [17 / No.] Rsk-0.5--1.3 and 40-250 micrometers of RSm(s) about Rsk-1.0, RSm300micrometer, and No.19 except Rsk-1.5, RSm120micrometer, No.17, and No.19.

[0051] It was distorted and annealing was based on the following conditions. No.20 -- H2 : 60vol% and O2 : 0.006vol% and the remainder -- N2 from -- it became, it is the atmosphere whose dew-point is -40 degrees C, and the temperature up was carried out in a second in 60 degrees C /, and after annealing for 0.1 seconds at 540 degrees C, it cooled in a second in 120 degrees C / About No.21, it was the same atmosphere as No.20, the temperature up was carried out in a second in 15 degrees C /, and after annealing for 450 seconds at 540 degrees C, it cooled in a second in 2.5 degrees C /. others -- H2 : 70vol% and O2 : 0.005vol% and the remainder -- N2 from -- it became, it is the atmosphere whose dew-point is -50 degrees C, and the temperature up was carried out in a second in 5 degrees C /, and after heating for 300 seconds at 540 degrees C, it cooled in a second in 20 degrees C /

[0052] The surface roughness of the obtained alloy sheet metal, oxide-film thickness, a contact angle, and degreasing nature were investigated and evaluated like the example 1. A result is shown in Table 4.

[0053]

[Table 3]

鋼No.	化学成分 (wt%)												
	Ni	H(ppm)	Mn	Si	O	N	B	P	S	C	Co	Sn	
E	41.7	0.3	0.31	0.02	0.0021	0.0013	0.0001	0.001	0.0009	0.0027	—	0.006	
F	40.8	0.7	0.03	0.001	0.0026	0.0013	<0.0001	0.002	0.0011	0.0013	0.012	0.005	
G	42.3	1.0	0.47	0.03	0.0014	0.0007	0.0002	0.004	0.0014	0.0019	0.831	0.004	
H	29.6	1.0	0.38	0.02	0.0023	0.0010	<0.0001	0.003	0.0008	0.0522	6.610	0.016	
I	26.1	0.4	0.34	0.03	0.0013	0.0013	0.0002	0.001	0.0006	0.0522	16.720	0.065	
N	38.9	1.5	0.49	0.20	0.0035	0.0018	0.0003	0.005	0.0023	0.0089	1.63	0.162	
O	41.1	2.1	0.45	0.15	0.0041	0.0022	0.0005	0.006	0.0025	0.0162	—	0.0001	
P	29.6	1.3	0.49	0.21	0.0030	0.0026	0.0003	0.006	0.0022	0.0182	17.48	0.132	
Q	40.9	1.4	0.35	0.07	0.0028	0.0028	0.0003	0.008	0.0029	0.0242	—	0.010	

[0054]
[Table 4]

材料No.	合金No.	材料の表面粗さ		酸化膜厚さ (Å)	接触角 (°)	脱脂性		備考
		Rsk	RSm (μm)			均一性	水きり性	
11	E	0.6	80	110	70	○	○	発明例
12	F	1.2	130	40	50	○	○	発明例
13	G	0.5	100	10	45	○	○	発明例
14	H	0.9	180	30	60	○	○	発明例
15	I	1.4	150	20	40	○	○	発明例
16	N	0.6	170	270	110	×	○	比較例
17	O	1.0	280	190	100	×	○	比較例
18	P	0.5	80	220	120	×	○	比較例
19	Q	0.2	120	50	110	×	○	比較例
20	E	1.0	120	<10	30	○	×	比較例
21	E	0.6	100	250	110	×	○	比較例

[0055] From this result, homogeneity and the drainer nature of No.11-No.15 of the example of this invention are good, and the outstanding degreasing nature is shown. Moreover, the photo etching of such material was good. On the other hand, each of No.16 to which Sn content exceeds the upper limit of this invention, No.18 and No.17 to which RSm exceeds the upper limit of this invention, No.21 in which a cooling rate is less than the range of this invention, and No.19 in which Rsk is less than the minimum of this invention is inferior in homogeneity. Moreover, No.20 to which a programming rate exceeds the range of this invention are inferior in drainer nature.
[0056] (Example 3) Using the hot-rolling coil created on condition that No.1-No.4 using alloy A-D of an example 1, and the same hot-rolling coil, cold rolling-annealing-finishing rolling-stress relieving annealing was performed and alloy sheet metal No.31-No.51 of 0.15mm of board thickness were obtained.
[0057] Finishing rolling rolled out using the work roll Rsk-0.3--1.3 and whose diameter of a roll of 40-250 micrometers of RSm(s) are 120mm. The rate of rolling of finishing rolling and the conditions of stress relieving annealing are shown in Table 5.
[0058] The surface roughness of the obtained alloy sheet metal, oxide-film thickness, a water wetting angle, and degreasing nature were investigated and evaluated like the example 1. A result is shown in Table 6.
[0059]
[Table 5]

材料No.	合金No.	仕上げ冷延率(%)	応力除去焼鈍・昇温速度(℃/秒)	応力除去焼鈍温度(℃)	応力除去焼鈍・冷却速度(℃/秒)	応力除去焼鈍雰囲気の露点(℃)	応力除去焼鈍雰囲気 1)		備考
							H_2 (vol%)	O_2 (vol%)	
31	A	85	20	500	20	−50	50	0.01	比較例
32	A	10	50	500	40	−50	60	0.01	比較例
33	C	30	30	700	35	−40	50	0.01	比較例
34	C	25	15	430	15	−40	50	0.005	比較例
35	B	21	1	450	8	−50	50	0.01	比較例
36	B	25	55	450	6	−10	60	0.01	比較例
37	A	25	20	540	2	−40	65	0.01	比較例
38	C	29	30	540	160	−30	40	0.01	比較例
39	A	29	40	540	30	−5	70	0.01	比較例
40	A	60	45	500	8	−70	10	0.02	比較例
41	B	50	50	690	12	−20	30	0.03	比較例
42	C	20	35	450	19	−40	0.5	0.01	比較例
43	A	17	7	600	30	−50	60	0.005	発明例
44	B	17	13	450	45	−60	90	0.005	発明例
45	C	21	10	500	50	−40	94	0.010	発明例
46	A	21	30	500	40	−55	99	0.001	発明例
47	C	30	15	480	15	−35	80	0.010	発明例
48	A	70	20	680	20	−50	65	0.005	発明例
49	C	15	10	500	25	−50	65	0.010	発明例
50	B	35	45	540	15	−40	70	0.001	発明例
51	D	29	30	480	5	−20	99	0.005	発明例

1) 残部：N_2

[0060]
[Table 6]

材料No.	合金No.	材料の表面粗さ		酸化膜厚さ(Å)	接触角(°)	脱脂性		備考
		Rsk	RSm (μm)			均一性	水ぬけ性	
31	A	0.6	145	220	110	×	○	比較例
32	A	1.3	190	<10	30	○	×	比較例
33	C	0.5	50	230	120	×	○	比較例
34	C	1.0	42	<10	25	○	×	比較例
35	C	1.1	70	260	120	×	○	比較例
36	B	1.5	78	<10	30	○	×	比較例
37	B	0.8	85	250	110	×	○	比較例
38	A	0.9	90	<10	25	○	×	比較例
39	C	0.6	94	230	110	×	○	比較例
40	A	1.0	102	<10	30	○	×	比較例
41	B	0.4	70	230	120	×	○	比較例
42	C	0.6	50	250	110	×	○	比較例
43	A	1.0	120	10	40	○	○	発明例
44	B	0.6	105	30	45	○	○	発明例
45	C	0.8	170	60	55	○	○	発明例
46	A	1.2	100	30	47	○	○	発明例
47	C	0.5	95	40	50	○	○	発明例
48	A	0.8	130	140	80	○	○	発明例
49	C	0.8	120	10	43	○	○	発明例
50	B	1.0	190	70	60	○	○	発明例
51	D	1.2	63	50	55	○	○	発明例

[0061] No.43-No.51 of the example of this invention have the oxide-film thickness of this invention convention within the limits, and surface roughness, and show the degreasing nature which is good as for the homogeneity of degreasing nature, and drainer nature, and was excellent. Degreasing nature good also about No.51 containing 1% or more of Co is shown.
[0062] As opposed to this The rate of rolling of finishing rolling this invention convention upper limit No.31 and the annealing temperature to exceed the upper limit of this invention No.33 and the programming rate to exceed the minimum of this invention O2 in No.39 and annealing atmosphere where No.35 are less than, No.37 in which a cooling rate is less than the minimum of this invention, and a dew-point exceed the upper limit of this invention H2 in No.41 and atmosphere where concentration exceeds the upper limit of this invention No.42, in which concentration is less than the minimum of this invention Oxide-film thickness exceeds 200A, a contact angle exceeds the upper limit of this invention, and homogeneity is inferior in all.
[0063] On the other hand, oxide-film thickness is less than 10A, a water wetting angle is less than the minimum of this invention, and each of No.32 in which the rate of rolling of finishing rolling separates from the minimum of this invention,

No.34 in which an annealing temperature is less than the range of this invention, No.36 to which a programming rate exceeds the upper limit of this invention, No.38 to which a cooling rate exceeds the upper limit of this invention, and No.40 in which a dew-point is less than the minimum

[0064] (Example 4) Using the hot-rolling coil created on condition that No.11-No.15 using alloy E-I of an example 2, and the same hot-rolling coil, cold-rolled rolling-annealing-finishing cold-rolled-stress relieving annealing was performed, and alloy sheet metal No.62-No.83 of 0.15mm of board thickness were obtained.

[0065] Finishing rolling rolled out using the work roll whose diameter of a roll is 120mm by Rsk-0.5--1.5 and 40-250 micrometers of RSm(s). The rate of rolling of finishing rolling and the conditions of stress relieving annealing are shown in Table 7.

[0066] The surface roughness of the obtained alloy sheet metal, oxide-film thickness, a contact angle, and degreasing nature were investigated and evaluated like the example 1. A result is shown in Table 8.

[0067]

[Table 7]

材料No.	合金No.	仕上げ冷延率(%)	応力除去焼鈍・昇温速度(℃/秒)	応力除去焼鈍温度(℃)	応力除去焼鈍・冷却速度(℃/秒)	応力除去焼鈍雰囲気の露点(℃)	応力除去焼鈍雰囲気1)		備考
							H_2 (vol%)	O_2 (vol%)	
62	F	83	25	500	20	−50	60	0.01	比較例
63	G	12	50	500	16	−50	50	0.01	比較例
64	E	25	8	700	43	−30	50	0.01	比較例
65	F	20	15	400	8	−50	60	0.005	比較例
66	F	35	2	480	17	−60	60	0.01	比較例
67	E	35	55	520	26	−40	60	0.01	比較例
68	E	23	10	530	2	−30	50	0.01	比較例
69	G	19	25	450	170	−40	50	0.005	比較例
70	E	23	35	450	27	−5	20	0.01	比較例
71	F	19	40	450	10	−65	70	0.02	比較例
72	E	35	25	560	16	−30	30	0.03	比較例
73	G	60	15	450	23	−50	0.5	0.01	比較例
74	F	80	5	550	38	−50	90	0.005	発明例
75	E	15	10	540	47	−30	95	0.01	発明例
76	G	17	8	600	38	−45	95	0.01	発明例
77	E	23	16	450	29	−40	60	0.01	発明例
78	F	30	29	680	16	−45	50	0.005	発明例
79	G	23	47	500	10	−50	60	0.0001	発明例
80	E	70	30	520	27	−45	50	0.005	発明例
81	F	25	13	550	19	−35	99	0.01	発明例
82	H	29	26	550	36	−45	60	0.005	発明例
83	I	30	43	550	5	−50	70	0.005	発明例

1) 残部：N_2

[0068]

[Table 8]

材料No.	合金No.	表面粗度		酸化膜厚さ(Å)	接触角(°)	脱脂性		備考
		Rsk	RSm (μm)			均一性	水ぬれ性	
62	F	0.5	150	220	120	×	○	比較例
63	G	0.8	185	<10	28	○	×	比較例
64	F	1.2	135	230	110	×	○	比較例
65	F	1.0	110	<10	30	○	×	比較例
66	F	0.9	100	240	105	×	○	比較例
67	E	0.5	105	<10	35	○	×	比較例
68	E	0.8	120	220	110	×	○	比較例
69	G	1.5	125	<10	35	○	×	比較例
70	E	0.7	95	230	115	×	○	比較例
71	F	0.9	125	<10	33	○	×	比較例
72	C	1.2	115	220	110	×	○	比較例
73	C	1.2	120	230	120	×	○	比較例
74	F	1.0	130	140	80	○	○	発明例
75	E	0.9	100	10	40	○	○	発明例
76	G	0.7	105	30	48	○	○	発明例
77	E	0.7	120	20	45	○	○	発明例
78	F	0.9	156	60	60	○	○	発明例
79	G	1.5	100	20	45	○	○	発明例
80	E	1.4	125	80	85	○	○	発明例
81	F	0.5	110	40	50	○	○	発明例
82	H	0.6	50	30	47	○	○	発明例
83	I	0.9	65	40	55	○	○	発明例

[0069] No.74-No.83 of the example of this invention have the oxide-film thickness of this invention convention within the limits, and surface roughness, and the homogeneity of degreasing nature and its drainer nature are good. The degreasing nature which was excellent similarly about No.82 containing 1% or more of Co and No.83 is shown.
[0070] As opposed to this The rate of rolling of finishing rolling the upper limit of this invention No.62 and the annealing temperature to exceed the upper limit of this invention No.64 and the programming rate to exceed the minimum of this invention O2 in No.70 and atmosphere where No.66 from which it separates, No.68 in which a cooling rate separates from the minimum of this invention, and a dew-point exceed the upper limit of this invention No.72, to which concentration exceeds the upper limit of this invention, and H2 in atmosphere No.73 in which concentration separates from the minimum of this invention A contact angle is [all] less than the minimum of this invention by oxide-film thickness exceeding 200A, and homogeneity is inferior.
[0071] The oxide-film thickness of each No.71 in which the rate of rolling of finishing rolling separates from the minimum of this invention, and No.63, No.65 in which an annealing temperature separates from the minimum of this invention, No.67 to which a programming rate exceeds the upper limit of this invention, No.69 to which a cooling rate exceeds the upper limit of this invention, and a dew-point separate from the minimum of this invention on the other hand is less than 10A, and the contact angle is over the range of this invention,
[0072]
[Effect of the Invention] According to this invention, the Fe-nickel system alloy sheet metal and Fe-nickel-Co system alloy sheet metal which are excellent in degreasing nature, and its cheap manufacture method can be offered, and higher definition etching processing as a material is attained in these alloy sheet metal.

[Translation done.]

CLAIMS

[Claim(s)]

[Claim 1] Fe-nickel system alloy sheet metal for electronic parts which was excellent in weight % at the degreasing nature which it is Fe-nickel system alloy sheet metal containing less than [Sn:0.1%], and an oxide film with a thickness of 10-200A is formed in the front face nickel:26-52%, and is characterized by the contact angle of the front face by the waterdrop contact angle method on the oxide film concerned being 40-90 degrees.

[Claim 2] Fe-nickel system alloy sheet metal for electronic parts excellent in the degreasing nature according to claim 1 characterized by the surface roughness of the Fe-nickel system alloy sheet metal before the aforementioned oxide-film formation being RSm:40-200micrometer and Rsk:0.3-1.5.

[Claim 3] Fe-nickel-Co system alloy sheet metal for electronic parts which was excellent in weight % at the degreasing nature which it is Fe-nickel-Co system alloy sheet metal containing less than [Sn:0.1%], and an oxide film with a thickness of 10-200A is formed in the front face nickel:26-52% and Co:1-20%, and is characterized by the contact angle of the front face by the waterdrop contact angle method on the oxide film concerned being 40-90 degrees.

[Claim 4] Fe-nickel-Co system alloy sheet metal for electronic parts excellent in the degreasing nature according to claim 3 characterized by the surface roughness of the Fe-nickel-Co system alloy sheet metal before the aforementioned oxide-film formation being RSm:40-200micrometer and Rsk:0.3-1.5.

[Claim 5] By weight %, the Fe-nickel system alloy sheet metal containing less than [Sn:0.1%] nickel:26-52% Finishing rolling after obtaining cold rolling and annealing in Japanese common chestnut and carrying out 1 time or twice or more, The aforementioned finishing rolling is rolled out at 15 - 80% of rates of rolling using a dull roll in carrying out stress relieving annealing and manufacturing Fe-nickel system alloy sheet metal. The surface roughness is set to RSm:40-200micrometer and Rsk:0.3-1.5. Become more than H2 1vol%, less than [O2 0.02vol%], and a remainder real target from inert gas, and the aforementioned stress relieving annealing in the atmosphere whose dew-point is -10--60 degree C A temperature up is carried out by the 3-50 degrees C [/second] programming rate. at 450-690 degrees C of annealing temperatures After annealing, The manufacture method of the Fe-nickel system alloy sheet metal for electronic parts excellent in the degreasing nature characterized by having cooled with the cooling rate of 3-150 degrees C/second, having formed the oxide film with a thickness of 10-200A in the front face, and making the contact angle of the front face by the waterdrop contact angle method into 40-90 degrees.

[Claim 6] By weight %, the Fe-nickel-Co system alloy sheet metal containing less than [Sn:0.1%] nickel:26-52% and Co:1-20% Finishing rolling after obtaining cold rolling and annealing in Japanese common chestnut and carrying out 1 time or twice or more, In carrying out stress relieving annealing and manufacturing Fe-nickel-Co system alloy sheet metal The aforementioned finishing rolling is rolled out at 15 - 80% of rates of rolling using a dull roll. The surface roughness is set to RSm:40-200micrometer and Rsk:0.3-1.5. Become more than H2 1vol%, less than [O2 0.02vol%], and a remainder real target from inert gas, and the aforementioned stress relieving annealing in the atmosphere whose dew-point is -10--60 degree C A temperature up is carried out by the 3-50 degrees C [/second] programming rate. at 450-690 degrees C of annealing temperatures After annealing, The manufacture method of the Fe-nickel-Co system alloy sheet metal for electronic parts excellent in the degreasing nature characterized by having cooled with the cooling rate of 3-150 degrees C/second, having formed the oxide film with a thickness of 10-200A in the front face, and making the contact angle of the front face by the waterdrop contact angle method into 40-90 degrees.

[Translation done.]